

Dissolved mercury (Hg) speciation in the California Current System from samples collected on R/V Roger Revelle cruise RR2105 in July to August 2021

Website: <https://www.bco-dmo.org/dataset/926873>

Data Type: Cruise Results

Version: 1

Version Date: 2024-05-14

Project

- » [California Current Ecosystem Long Term Ecological Research site](#) (CCE LTER)
- » [Collaborative Proposal: Unravelling the Oceanic Dimethylmercury Cycle](#) (DMHg in the Ocean)

Programs

- » [Ocean Carbon and Biogeochemistry](#) (OCB)
- » [Long Term Ecological Research network](#) (LTER)

Contributors	Affiliation	Role
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Abstract

Monomethylmercury (MMHg) is a neurotoxicant that biomagnifies in marine food webs, reaching high concentrations in apex predators. To predict changes in oceanic MMHg concentrations, it is important to quantify its sources and sinks. Here, we study mercury speciation in the California Current System through cruise sampling and modeling. Previous work in the California Current System has found that upwelling impacts mercury biogeochemistry by transporting mercury-enriched deep waters to productive surface waters. These upwelled waters originate within the California Undercurrent water mass and are subsequently advected as a surface water parcel to the California Current. By comparing the two major water masses, we find that the California Undercurrent contains elevated dissolved total mercury (Hg) and Dimethylmercury (DMHg) concentrations by 57% and 60%, respectively, compared to the California Current. We explain that these differences result from losses during advection, specifically scavenging and DMHg demethylation. We calculate a net DMHg demethylation rate constant of $1.8 \pm 0.9\%$ per day, and build an empirically constrained mass budget model to demonstrate that DMHg demethylation accounts for 59% of surface MMHg sources. These findings illustrate that DMHg is a significant source of MMHg in this region, challenging the current understanding of the major sources of marine MMHg. These data are associated with Adams et al., 2024 (doi: 10.21203/rs.3.rs-3909481/v1).

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Coverage

Location: California Current System, Northeastern Pacific Ocean

Spatial Extent: N:36.561859 E:-120.406468 S:34.423331 W:-130.54799

Temporal Extent: 2021-07-19 - 2021-08-09

Methods & Sampling

Sampling Plan:

This study was conducted during the California Current Ecosystem Long Term Ecological Research (CCE LTER) Process Cruise P2105 from July 10 to August 8, 2021, on board the R/V Roger Revelle (RR2105) where we sampled two water parcels and a seven station transect. Water parcels were sampled with a Lagrangian-style process study using drifter floats and modeled after previous CCE LTER cruises (Krause et al., 2015; Landry et al., 2009). During these process studies, an upwelled water parcel was identified by satellite temperature and chlorophyll-a concentrations. We followed an upwelled water parcel for 11 days and a water parcel that had already moved to the eastern edge of the oligotrophic gyre for three days. Profiles for dissolved Hg concentrations, including total mercury (THg), dimethylmercury (DMHg), monomethylmercury (MMHg), and elemental mercury (Hg₀), were taken every other day during the water parcel studies. A seven station transect from stations S1-S7 was conducted across the California Current water mass to the coast, and profiles for THg, DMHg, and Hg₀ were taken for all stations in the transect. A MMHg profile was only taken for Station S4 in the transect. Stations are colored based on their corresponding water mass in Figure 1 of Adams et al. (2024). Profiles for Hg speciation typically covered the upper water column to 200 meters (m), and those data are presented here. One station within the California Undercurrent was sampled to 600 m, and the concentrations of Hg species in the waters deeper than 200 m are used as a reference for upwelled waters in our mass budget model. Benthic Boundary Layer (BBL) stations were selected based on previous work in the region and are locations where the continental shelf drops off and can have high levels of suspended sediments within the water column (Billler and Bruland, 2013). Samples at BBL stations were taken at one depth around 40 to 70 m identified as 5 m above the sea floor (Billler and Bruland, 2013).

Sampling Methods:

Vertical dissolved Hg profiles were sampled using 5-liter (L) X-Niskin bottles (Ocean Test Equipment) mounted on a trace metal rosette (Seabird) deployed on a non-metallic hydroline (Brzezinski et al., 2015; Cutter and Bruland, 2012) and triggered automatically by pressure on upcasts using a Seabird Auto Fire Module. BBL samples were collected using a 30 L Teflon™-coated GO-Flo™ bottle (General Oceanics) deployed on a non-metallic hydroline and triggered with an acid-cleaned Teflon™ messenger (Bruland et al., 1979). The Niskin or GO-Flo™ bottles were transported into a dedicated Class 100 laboratory van under trace metal-clean conditions (Cutter and Bruland, 2012). Samples were pressure-filtered (N₂ gas, 99.99%) directly from the Niskin or GO-Flo™ bottles through 0.2 um capsule filters (Acropak 200, Pall Laboratory) into 2 L acid-cleaned Teflon™ bottles.

An aliquot of sample was transferred from the 2 L Teflon™ bottle into 0.25 L pre-cleaned borosilicate glass bottles (I-Chem) for THg analysis and oxidized with 0.04% bromine monochloride at least 12 hours prior to analysis (U.S. Environmental Protection Agency Method 1631, Revision E).

The remainder of the sample in the 2 L Teflon™ bottle was analyzed for gaseous Hg₀ and DMHg with a purge-and-trap method (Bowman et al., 2011; Tseng et al., 2004). Samples were purged with Hg-free N₂ gas for 60 minutes; at a rate of 0.5 L per minute. Effluent gas was passed through a soda lime trap to remove water vapor and aerosols, then DMHg was concentrated onto a Carbotrap® (graphitized carbon black, Sigma-Aldrich) matrix downstream of the soda lime trap, and Hg₀ was concentrated onto a gold trap downstream of the Carbotrap® (Tseng et al., 2004; Lamborg et al., 2012). DMHg was thermally desorbed from the Carbotrap® and quantified on board via Gas Chromatographic Cold Vapor Atomic Fluorescence Spectrometry (GC-CVAFS) on a Tekran 2500 (Bowman et al., 2011; Baya et al., 2013). The detection limit for DMHg was 2 fM. Hg₀ was quantified by dual gold amalgamation Cold Vapor Atomic Fluorescence Spectroscopy (CVAFS) on a Tekran 2600 following thermal desorption from the gold trap (Tseng et al., 2004; Bloom and Fitzgerald, 1988). The method detection limits for Hg₀ were 40 fM (n=14). Sample concentrations for DMHg and Hg₀ were determined by a calibration curve based on a gaseous Hg₀ standard (Tekran 2505 Mercury Vapor Primary Calibration Unit).

Seawater purged of DMHg and Hg₀ was transferred into a 0.25 L pre-cleaned amber borosilicate glass bottles (I-Chem) for MMHg analysis, acidified with 1% sulfuric acid (Trace Metal Grade, Fisher Scientific), stored at 4°C, and analyzed at Scripps Institution of Oceanography within 2 months of collection.

THg samples were analyzed following U.S. EPA Method 1631 on board the ship (U.S. Environmental Protection Agency Method 1631, Revision E; Lamborg et al., 2012). Samples

were reduced to Hg₀ with 20% wt:vol tin (II) chloride solution (ACS grade, Fisher Chemical) in 10% hydrochloric acid (ACS grade, Fisher Chemical). Hg₀ was purged onto a gold trap with Hg-free argon gas and thermally desorbed via CVAFS for detection using a Tekran 2600 Automated Mercury Analyzer. Sample concentrations were determined by a calibration curve based on a gaseous Hg₀ standard (Tekran 2505 Mercury Vapor Primary Calibration Unit). The method detection limit was 0.22 pM (n=8 blanks) and replicates had an average precision of 6.4% (n = 73).

MMHg samples were analyzed by ascorbic acid-assisted direct ethylation following Munson et al. (2014) and U.S. EPA Method 1630 (U.S. Environmental Protection Agency Method 1630; Munson et al., 2014). Samples were adjusted to a pH of 4.8 using a 2 M acetate/glacial acetic acid buffer (J.T. Baker) in ultrapure water (Milli-Q, 18.2 MW per centimeter) and 8 M potassium hydroxide (J.T. Baker) in ultrapure water (Milli-Q, 18.2 MW per centimeter). 2.5% wt:vol ascorbic acid (J.T. Baker) in ultrapure water (Milli-Q, 18.2 MW per centimeter) was added to the samples, then samples were ethylated with sodium tetraethylborate (NaTEB) solution (1% NaTEB in 2% potassium hydroxide, Strem Chemicals) to convert MMHg to volatile methylethylmercury. Ethylation was allowed to proceed for 10 minutes before sample analysis. Samples were analyzed by GC-CVAFS on a Tekran 2700 Automated Methylmercury Analyzer. Concentrations were determined by a calibration curve based on standards prepared from a certified 1000 ppm MMHg (II) chloride standard (Alfa Aesar). The method detection limit was 11.3 fM (n=9 blanks), and ongoing precision and recovery was 98.4 ± 7.9% (n=25). Replicates had an average precision of 9.2% (n=18) and matrix spike recovery was 112 ± 13% (n=15).

BCO-DMO Processing Description

- Imported original file "2024-0311-California Current System Dissolved Hg Speciation.xlsx" into the BCO-DMO system.
- Marked "N/A" as a missing data value (missing data are empty/blank in the final CSV file).
- Made corrections in the time column: added "AM" where needed to the times missing them and converted the times that were in 24-hour time to 12-hour AM/PM time.
- Converted the date and time columns into ISO 8601 format in PDT and UTC time zones.
- Renamed fields to comply with BCO-DMO naming conventions.
- Saved final file as "926873_v1_dissolved_hg_speciation_california_current_system.csv".

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Data Files

File
926873_v1_dissolved_hg_speciation_california_current_system.csv (Comma Separated Values (.csv), 23.99 KB) MD5:cb43298c5a2653f5f4ce4e405d1c86
Primary data file for dataset ID 926873, version 1

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Related Publications

Adams, H. M., Cui, X., Lamborg, C. H., & Schartup, A. T. (2024). Dimethylmercury as a Source of Monomethylmercury in a Highly Productive Upwelling System. <https://doi.org/10.21203/rs.3.rs-3909481/v1>
Results

Baya, P. A., Hollinsworth, J. L., & Hintelmann, H. (2013). Evaluation and optimization of solid adsorbents for the sampling of gaseous methylated mercury species. *Analytica Chimica Acta*, 786, 61-69. doi:[10.1016/j.aca.2013.05.019](https://doi.org/10.1016/j.aca.2013.05.019)
Methods

Billar, D. V., & Bruland, K. W. (2013). Sources and distributions of Mn, Fe, Co, Ni, Cu, Zn, and Cd relative to macronutrients along the central California coast during the spring and summer upwelling season. *Marine Chemistry*, 155, 50-70. <https://doi.org/10.1016/j.marchem.2013.06.003>
Methods

Bloom, N., & Fitzgerald, W. F. (1988). Determination of volatile mercury species at the picogram level by low-temperature gas chromatography with cold-vapour atomic fluorescence detection. *Analytica Chimica Acta*, 208, 151-161. doi:10.1016/s0003-2670(00)80743-6 [https://doi.org/10.1016/S0003-2670\(00\)80743-6](https://doi.org/10.1016/S0003-2670(00)80743-6)
Methods

Bowman, K. L., & Hammerschmidt, C. R. (2011). Extraction of monomethylmercury from seawater for low-femtomolar determination. *Limnology and Oceanography: Methods*, 9(4), 121-128. doi:[10.4319/lom.2011.9.121](https://doi.org/10.4319/lom.2011.9.121)
Methods

Bruland, K. W., Franks, R. P., Knauer, G. A., & Martin, J. H. (1979). Sampling and analytical methods for the determination of copper, cadmium, zinc, and nickel at the nanogram per liter level in sea water. *Analytica Chimica Acta*, 105, 233-245. doi:10.1016/s0003-2670(01)83754-5 [https://doi.org/10.1016/S0003-2670\(01\)83754-5](https://doi.org/10.1016/S0003-2670(01)83754-5)
Methods

Brzezinski, M. A., Krause, J. W., Bundy, R. M., Barbeau, K. A., Franks, P., Goericke, R., Landry, M. R., & Stukel, M. R. (2015). Enhanced silica ballasting from iron stress sustains carbon export in a frontal zone within the California Current. *Journal of Geophysical Research: Oceans*, 120(7), 4654-4669. Portico. <https://doi.org/10.1002/2015jc010829>
Methods

Cutter, G. A., & Bruland, K. W. (2012). Rapid and noncontaminating sampling system for trace elements in global ocean surveys. *Limnology and Oceanography: Methods*, 10(6), 425-436. doi:[10.4319/lom.2012.10.425](https://doi.org/10.4319/lom.2012.10.425)
Methods

Krause, J. W., Brzezinski, M. A., Goericke, R., Landry, M. R., Ohman, M. D., Stukel, M. R., & Taylor, A. G. (2015). Variability in diatom contributions to biomass, organic matter production and export across a frontal gradient in the California Current Ecosystem. *Journal of Geophysical Research: Oceans*, 120(2), 1032-1047. Portico. <https://doi.org/10.1002/2014jc010472> <https://doi.org/10.1002/2014JC010472>
Methods

Lamborg, C. H., Hammerschmidt, C. R., Gill, G. A., Mason, R. P., & Gichuki, S. (2012). An intercomparison of procedures for the determination of total mercury in seawater and recommendations regarding mercury speciation during GEOTRACES cruises. *Limnology and Oceanography: Methods*, 10(2), 90-100. doi:[10.4319/lom.2012.10.90](https://doi.org/10.4319/lom.2012.10.90)
Methods

Landry, M. R., Ohman, M. D., Goericke, R., Stukel, M. R., & Tsyrlkevich, K. (2009). Lagrangian studies of phytoplankton growth and grazing relationships in a coastal upwelling ecosystem off Southern California. *Progress in Oceanography*, 83(1-4), 208-216. doi:[10.1016/j.pocean.2009.07.026](https://doi.org/10.1016/j.pocean.2009.07.026)
Methods

Munson, K. M., Babi, D., & Lamborg, C. H. (2014). Determination of monomethylmercury from seawater with ascorbic acid-assisted direct ethylation. *Limnology and Oceanography: Methods*, 12(1), 1-9. doi:[10.4319/lom.2014.12.1](https://doi.org/10.4319/lom.2014.12.1)
Methods

Tseng, C. M., Lamborg, C., Fitzgerald, W. F., & Engstrom, D. R. (2004). Cycling of dissolved elemental mercury in Arctic Alaskan lakes. *Geochimica et Cosmochimica Acta*, 68(6), 1173-1184. <https://doi.org/10.1016/j.gca.2003.07.023>
Methods

U.S. Environmental Protection Agency. Method 1630: Methyl Mercury in Water by Distillation, Aqueous Ethylation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry; Washington, D.C., 1998. https://www.epa.gov/sites/default/files/2015-08/documents/method_1630_1998.pdf
Methods

U.S. Environmental Protection Agency. Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry Method 1631, Revision E; Washington, D.C., 2002. https://www.epa.gov/sites/default/files/2015-08/documents/method_1631e_2002.pdf
Methods

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Parameters

Parameter	Description	Units
Water_Mass	Identification of water mass	unitless
Station_Name	Name of the station	unitless
ISO_DateTime_PDT	Sampling date and time in ISO 8601 format in Pacific Daylight Time (PDT) time zone	unitless
ISO_DateTime_UTC	Sampling date and time in ISO 8601 format in UTC time zone	unitless
Latitude	Station latitude, south is negative	decimal degrees
Longitude	Station longitude, west is negative	decimal degrees
Trace_Metal_Cast_Num	Cast number	unitless
Depth_m	Sample depth	meters (m)
Temperature_C	Sample temperature	degrees Celsius
Salinity_PSU	Sample salinity	practical salinity units (PSU)
Oxygen_umol_kg	Dissolved oxygen concentration	micromole per kilogram (umol/kg)
Density_kg_m3	Water density	kilogram per cubed meter (kg/m ³)
DMHg_fM	Concentration of dimethylmercury; limit of detection = 2	femtomolar (fM)
DMHg_Flag	Data flag, 0 indicates that the data was used in analyses, 1 indicates that the data was removed from subsequent analysis as it was 1.5*IQR above the upper whisker when the data was plotted as a box plot	unitless
Hg0_fM	Concentration of elemental mercury; limit of detection = 40	femtomolar (fM)
Hg0_Flag	Data flag, 0 indicates that the data was used in analyses, 1 indicates that the data was removed from subsequent analysis as it was 1.5*IQR above the upper whisker when the data was plotted as a box plot	unitless
MMHg_fM	Concentration of dissolved monomethylmercury; limit of detection = 11.3	femtomolar (fM)
MMHg_Flag	Data flag, 0 indicates that the data was used in analyses, 1 indicates that the data was removed from subsequent analysis as it was 1.5*IQR above the upper whisker when the data was plotted as a box plot	unitless
THg_pM	Concentration of dissolved total mercury; limit of detection = 0.22	picomolar (pM)
THg_Flag	Data flag, 0 indicates that the data was used in analyses, 1 indicates that the data was removed from subsequent analysis as it was 1.5*IQR above the upper whisker when the data was plotted as a box plot	unitless

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Instruments

Dataset-specific Instrument Name	30 L Teflon™-coated GO-Flo™ bottle (General Oceanics)
Generic Instrument Name	GO-FLO Bottle
Dataset-specific Description	Used for dissolved mercury samples collected at Benthic Boundary Layer Stations.
Generic Instrument Description	GO-FLO bottle cast used to collect water samples for pigment, nutrient, plankton, etc. The GO-FLO sampling bottle is specially designed to avoid sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

Dataset-specific Instrument Name	5 L X-Niskin bottles (Ocean Test Equipment)
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Dissolved mercury samples were collected using a trace metal clean rosette equipped with 5-liter X-Niskin bottles.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Seabird Scientific SBE-43
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	Depth, temperature, salinity, and oxygen concentrations were determined from real-time hydrographic data from the ship's rosette using Seabird Scientific SBE11, SBE-43, and SBE-45 devices.
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Seabird Scientific SBE-45
Generic Instrument Name	Sea-Bird SBE 45 MicroTSG Thermosalinograph
Dataset-specific Description	Depth, temperature, salinity, and oxygen concentrations were determined from real-time hydrographic data from the ship's rosette using Seabird Scientific SBE11, SBE-43, and SBE-45 devices.
Generic Instrument Description	A small externally powered, high-accuracy instrument, designed for shipboard determination of sea surface (pumped-water) conductivity and temperature. It is constructed of plastic and titanium to ensure long life with minimum maintenance. It may optionally be interfaced to an external SBE 38 hull temperature sensor. Sea Bird SBE 45 MicroTSG (Thermosalinograph)

Dataset-specific Instrument Name	Gas Chromatographic Cold Vapor Atomic Fluorescence Spectrometry (GC-CVAFS) on a Tekran 2500
Generic Instrument Name	Tekran 2500 CVAFS mercury detector
Dataset-specific Description	Dissolved dimethylmercury concentrations were measured using a Tekran 2500.
Generic Instrument Description	Tekran 2500 Total Mercury Analysis System (not automated; cold vapor atomic fluorescence spectrometry)

Dataset-specific Instrument Name	Cold Vapor Atomic Fluorescence Spectroscopy (CVAFS) on a Tekran 2600 Automated Mercury Analyzer
Generic Instrument Name	Tekran 2600 Automated Sample Analysis System
Dataset-specific Description	Dissolved Total Mercury and elemental mercury were analyzed on a Tekran 2600.
Generic Instrument Description	The Tekran Series 2600 system allows the analysis of ultra-trace levels of total mercury in laboratory prepared environmental samples (water, biota, soil, sediments, gas cartridges, effluents and more). The Series 2600 is capable of providing a fully automated implementation of EPA Method 1631. This method is capable of measuring waters and digested solids with detection limits over 10X lower than required. See: https://www.tekran.com/products/laboratory/tekran-model-2600-automated-t...

Dataset-specific Instrument Name	GC-CVAFS on a Tekran 2700 Automated Methylmercury Analyzer
Generic Instrument Name	Tekran Model 2700 Automated Methyl Mercury Analysis System
Dataset-specific Description	Dissolved monomethylmercury was measured on a Tekran 2700.
Generic Instrument Description	The Tekran 2700 Methyl Mercury Auto-Analysis System offers a fully integrated, compact unit based on atomic fluorescence detection. The system is pre-programmed to run EPA Method 1630. However, the Model 2700 offers customization including: 1) GC column temperature ramping, 2) Programmable analysis cycle settings, 3) High-temperature purge cycles, and 4) Choice of trap and GC column. The 2700 will also interface with ICP-MS or other analytical instruments. See: https://www.tekran.com/products/laboratory/tekran-model-2700-automated-m...

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Deployments

RR2105

Website	https://www.bco-dmo.org/deployment/926884
Platform	R/V Roger Revelle
Start Date	2021-07-13
End Date	2021-08-13
Description	California Current Ecosystem Long Term Ecological Research Process Cruise, CCE LTER III. Also referred to as "P2107". See more information from R2R: https://www.rvdata.us/search/cruise/RR2105

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Project Information

California Current Ecosystem Long Term Ecological Research site (CCE LTER)

Website: <http://cce.lternet.edu/>

Coverage: California coastal current

from ccelter.edu The California Current System is a coastal upwelling biome, as found along the eastern margins of all major ocean basins. These are among the most productive ecosystems in the world ocean. The California Current Ecosystem LTER (32.9 degrees North, 120.3 degrees West) is investigating nonlinear transitions in the California Current coastal pelagic ecosystem, with particular attention to long-term forcing by a secular warming trend, the Pacific Decadal Oscillation, and El Nino in altering the structure and dynamics of the pelagic ecosystem. The California Current sustains active fisheries for a variety of finfish and marine invertebrates, modulates weather patterns and the hydrologic cycle of much of the western United States, and plays a vital role in the economy of myriad coastal communities.

LTER Data: The California Current Ecosystem (CCE) LTER data are managed by and available directly from the CCE project data site URL shown above. If there are any datasets listed below, they are data sets that were collected at or near the CCE LTER sampling locations, and funded by NSF OCE as ancillary projects related to the CCE LTER core research themes.

Collaborative Proposal: Unravelling the Oceanic Dimethylmercury Cycle (DMHg in the Ocean)

Coverage: Monterey Bay, California Current, Greenland

NSF Award Abstract

This project will study how dimethylmercury is formed and removed in the oceans. Dimethylmercury is a naturally occurring compound. It is thought to be formed when man-made mercury is converted into monomethylmercury, a toxin that accumulates in fish. Despite representing a large fraction of mercury in the oceans, the origin and fate of dimethylmercury is not known. This research will use state-of-the-art analytical, genomic and modeling tools to address this information gap. It will also train graduate and undergraduate students to use field, experimental, and modeling methods. The results will be used in predictive models to forecast future trends in the oceanic mercury cycle. These models are needed to evaluate the effectiveness of international actions that seek to reverse increasing trends in the bioaccumulation of monomethylmercury in fish.

Methylated mercury species in the ocean are formed in sediment and the water column from inorganic divalent mercury delivered from the atmosphere and rivers. The putative mechanism is a two-step process during which monomethylmercury is formed first, followed by slow methylation into dimethylmercury. The first step, biomethylation of divalent mercury into monomethylmercury, is relatively well-studied in sediment and known to be driven by sulfate- and iron-reducing bacteria and methanogens. The mechanism for monomethylmercury formation in the water column is less well understood, and the process of dimethylmercury formation in sediment or seawater is essentially unknown. Until recently, it was assumed that dimethylmercury represented a small enough fraction of the methylated and total mercury (the sum of all mercury species) pools to be insignificant

in the global mercury cycle. Recent measurements, however, show that dimethylmercury levels in seawater can be in the same range as the other mercury species. This project will identify the biological and chemical methylating agents involved in the formation of dimethylmercury. Further, it will test the impact of varying biogeochemical conditions on dimethylmercury production. Results will be used to update the mercury module of the MIT General Circulation Model (MITgcm, a global biogeochemical model, and analyze the impacts of dimethylmercury production and degradation on monomethylmercury concentrations.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: <http://us-ocb.org/>

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO₂ and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

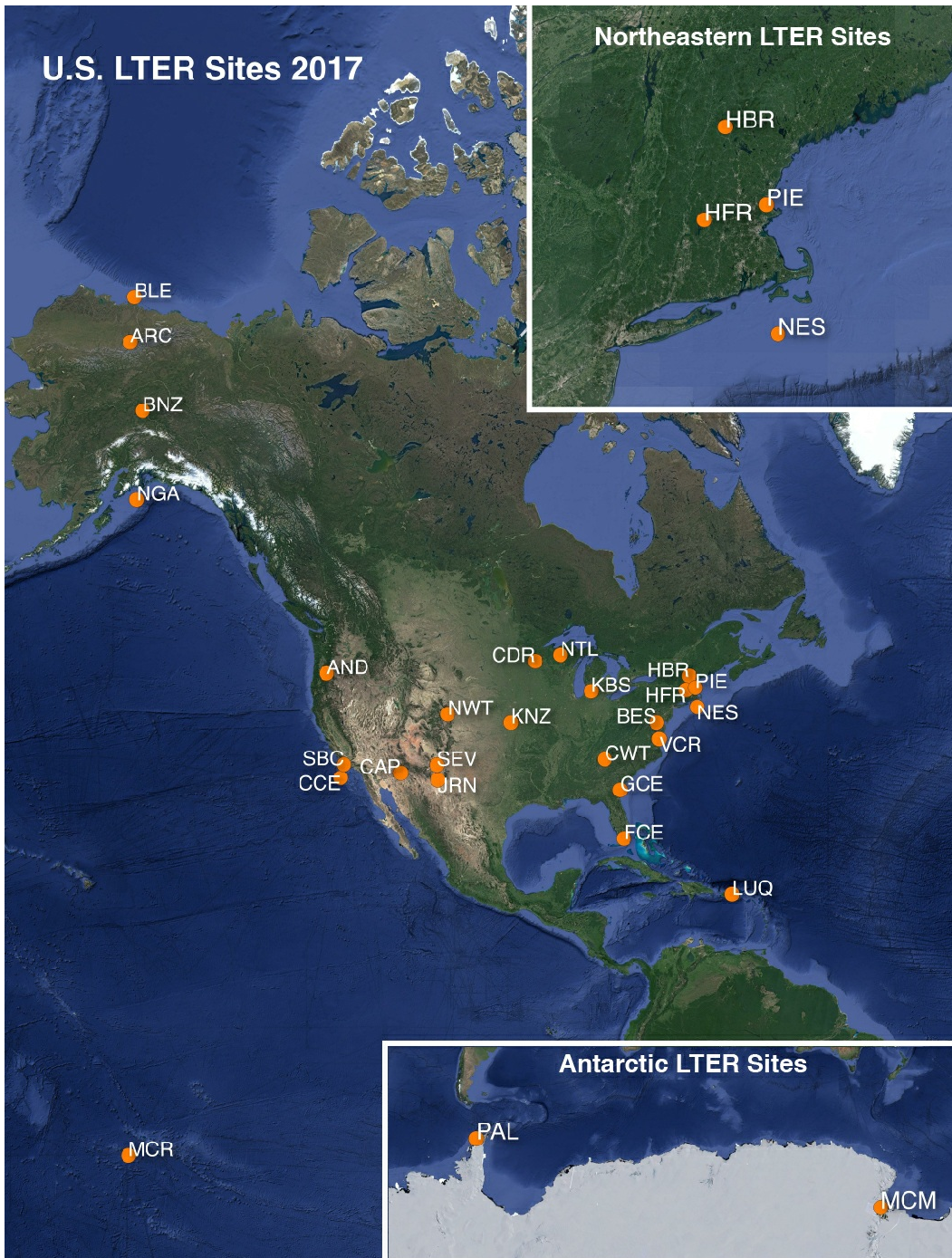
Long Term Ecological Research network (LTER)

Website: <http://www.lternet.edu/>

Coverage: United States

adapted from <http://www.lternet.edu/>

The National Science Foundation established the LTER program in 1980 to support research on long-term ecological phenomena in the United States. The Long Term Ecological Research (LTER) Network is a collaborative effort involving more than 1800 scientists and students investigating ecological processes over long temporal and broad spatial scales. The LTER Network promotes synthesis and comparative research across sites and ecosystems and among other related national and international research programs. The LTER research sites represent diverse ecosystems with emphasis on different research themes, and cross-site communication, network publications, and research-planning activities are coordinated through the LTER Network Office.



- Site Codes**
- AND Andrews Forest LTER
 - ARC Arctic LTER
 - BES Baltimore Ecosystem Stu
 - BLE Beaufort Lagoon Ecosystems LTER
 - BNZ Bonanza Creek LTER
 - CCE California Current Ecosystem LTER
 - CDR Cedar Creek Ecosystem Science Reserve
 - CAP Central Arizona-Phoenix LTER
 - CWT Coweeta LTER
 - FCE Florida Coastal Everglades LTER
 - GCE Georgia Coastal Ecosystems LTER
 - HFR Harvard Forest LTER
 - HBR Hubbard Brook LTER
 - JRN Jornada Basin LTER
 - KBS Kellogg Biological Station LTER
 - KNZ Konza Prairie LTER
 - LUQ Luquillo LTER
 - MCM McMurdo Dry Valleys LT
 - MCR Moorea Coral Reef LTER
 - NWT Niwot Ridge LTER
 - NTL North Temperate Lakes I
 - NES Northeast U.S. Shelf LTER
 - NGA Northern Gulf of Alaska I
 - PAL Palmer Antarctica LTER
 - PIE Plum Island Ecosystems LTER
 - SBC Santa Barbara Coastal L
 - SEV Sevilleta LTER
 - VCR Virginia Coast Reserve L

2017 LTER research site map obtained from <https://lternet.edu/site/lter-network/>

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1637632
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023046

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